Chapter 1 – Introduction

1.1 Introduction

This Risk Assessment (RA) was conducted to evaluate the potential for adverse impacts on human health and the environment associated with potential exposure to residual constituents present at the former DuPont Works Explosives manufacturing site (Site) located in Pierce County, Washington. Residual constituents are those constituents that remain in the soil, or other media, after the explosives manufacturing facility was decommissioned and after interim source removal of soil and debris. This report presents the methods, inputs, and assumptions used to identify areas on the Site with the potential for adverse impacts on human health and the environment that will be evaluated further in the feasibility study (FS). The RA was conducted in accordance with a Consent Decree, effective July 1991, between the lead agency, Washington State Department of Ecology (Ecology) and the principal responsible parties—The Weyerhaeuser Company (Weyerhaeuser) and E.I. duPont de Nemours and Company, Inc. (DuPont).

1.2 Location and Setting

1.2.1 Location and Site Characteristics

The Site initially consisted of two parcels and is located within the limits of the City of DuPont, Pierce County, Washington (see Figure 1-1). Remediation of Parcel 2 has been completed and this parcel was released for development by Ecology in December of 1997. Parcel 1, which is the focus of this RA, is located in the western part of the City of DuPont. The Site is bordered by Weyerhaeuser property to the north and west and Weyerhaeuser Real Estate Company (WRECO) property on the east, and south. Burlington Northern railroad property is adjacent to the Weyerhaeuser open space to the west. Puget Sound is located to the west of the Burlington Northern Railroad property.

1.2.2 Physical Setting

The significant physical features of relief across the Site are numerous glacial kettles (depressions), the east-west trending valley of Sequalitchew Creek, a steep bluff that partially borders Burlington Northern Railroad property, and a small kettle lake in the southern portion of the Site called Old Fort Lake. Site elevations generally range from 200 to 225 feet above mean sea level (MSL), except within the kettles, where elevations are approximately 150 feet above MSL. The Site lies in the Puget Sound area of the wet coniferous forest region and is generally forested with intermittent clearings associated with the former production activities. This document reflects Site conditions as of March 2002. Weyerhaeuser, DuPont, and Ecology recognize that there have been changes to the Site since that point in time.

Site soils consist primarily of Steilacoom gravels. These gravels are comprised of stratified sands and gravels. Soil horizons on top of the Steilacoom gravels consist of gravelly, sandy loam with variable amounts of organic matter.

Two water-bearing zones, or aquifers, occur beneath the Site—the shallow Water Table Aquifer, and the deeper Sea Level Aquifer. Across most of the Site, the relatively impermeable Aquitard within the "Olympia Beds/Possession Drift/Whidbey Formation/Double Bluff Drift sequence (Aquitard)" restricts vertical flow of groundwater, and separates the Water Table Aquifer from the deeper Sea Level Aquifer (Borden and Troost, 2001). Groundwater in the Water Table Aquifer flows toward the west-northwest, with local discharge via springs to upper Sequalitchew Creek. The deeper Sea Level Aquifer flows toward Puget Sound.

Surface water resources on the Site include Sequalitchew Creek and Old Fort Lake. The creek is fed by overflows from Sequalitchew Lake located approximately 1.4 miles east of the Site. The depth of Old Fort

Lake is shallow, and fluctuates with groundwater levels. Similar to Sequalitchew Creek, surface runoff to the lake is limited by rapid soil infiltration of rain water.

1.3 Risk Assessment Report Background

1.3.1 Preliminary Baseline Risk Assessment

In 1989, a preliminary baseline RA was conducted for the Site (ETI and Hart Crowser, 1989). Based on conditions present at the time, the preliminary baseline RA suggested that the estimated non-carcinogenic hazards associated with potential exposure to lead, arsenic and 2,4,6-trinitrotoluene (TNT) in soil were above levels of concern. In addition, the preliminary baseline RA suggested that the estimated cancer risks associated with potential exposure to 2,4-dinitrotoluene and 2,6-dinitrotoluene (DNT) and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) in soil were above levels of concern.

The preliminary RA also evaluated the potential for ecological impacts. The preliminary ecological RA indicated that aquatic organisms were not likely to be exposed to concentrations that could cause adverse impacts. A qualitative evaluation of the potential impacts on terrestrial wildlife indicated that potential impacts might be associated with exposure to constituents in hot spots which were present at the Site. These hot spots have subsequently been removed (PIONEER and West Shore, 2001).

1.3.2 Draft Risk Assessment Former DuPont Works Site, DuPont Washington

In 1994, a draft RA was conducted to evaluate potential exposures at each RI Area (i.e., former production areas and other areas of concern) to constituents detected above MTCA screening levels (DERS and Hart Crowser, 1994). Future land uses evaluated in the draft RA included residential, recreational (including open space and golf course), commercial, and industrial land use. The potential hazards and risks for each land use were evaluated, and the results of the draft human health RA indicated that several residential land use areas required further evaluation in the FS including: Areas 36, 38, 39, AP-C, AP-E, and the narrow gauge railroad (NGRR) based on exposure to arsenic, lead, and/or mercury in soil. The only future golf course or commercial land use areas that were identified in the draft RA as requiring further evaluation in the FS were Area 19 A and C, because of elevated concentrations of lead in soil (The location of these RI areas is shown in Chapter 2, Figure 2-3). No future industrial or open space land use areas required further evaluation based on the results of the draft RA.

A quantitative ecological RA was also conducted following the U.S. Environmental Protection Agency's (EPA) general framework. Historical and current surveys of the Site were used to determine indicator species including blacktail deer, red fox, red-tailed hawk, and Townsend vole. Potential risks to these indicator species were evaluated using available habitat and feeding habit information along with available toxicity data. The results of the draft ecological RA indicated no potential risk to large terrestrial mammals or avian species. Hazard quotients greater than one were calculated for voles in soil based on exposure to arsenic and/or mercury exposure in six areas of the Site (Areas 16, 26, 38, 39, AP-E, and Narrow Gauge Railroad (NGRR)).

1.3.3 Final Risk Assessment

The 1994 draft RA was reviewed by Ecology and others, and comments were provided. Since that time there have been a number of technical work group meetings, and meetings with Ecology, to evaluate and address various issues. The work, agreements, and changes in proposed land uses that resulted from these meetings include the following:

- Comments on the draft RA from Ecology and the Public.

- An agreement with Ecology on soil cleanup levels for total dinitrotoluene (2,4-dinitrotoluene and 2,6-dinitrotoluene) (Ecology, 1996), 2,4,6-trinitrotoluene (Ecology, 2001), mercury (Ecology, 1993), total petroleum hydrocarbons (TPH) and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) (Hart Crowser, 1996).

- An agreement with Ecology on a toxicity value for monomethylamine nitrate (MMAN) (Ecology and PIONEER, 1997).

- An agreement with Ecology on soil lead remediation levels for four land use types including, golf course, commercial, industrial, and open space (Ecology, 1999).

- An agreement with Ecology on soil arsenic remediation levels for three different land use types including, golf course, commercial, and industrial (Ecology, 1999b).

- A site background soil level for arsenic (See the RI).

- An agreement on the configuration of future land use evaluation units.

- A determination by Ecology that lead is the indicator compound for potential terrestrial ecological impacts.

- Extensive work to evaluate potential ecological risks at the Site (see Appendix A). Because no Site-specific agreements were reached regarding a lead cleanup level for ecological receptors, the current assessment utilizes an ecological soil screening concentration for lead developed by Ecology.

- Significant quantities of contaminated soil and debris have been removed and disposed of off-Site as the result of 2000 Hot Spot Removals and 2001 Interim Corrective Actions (PIONEER et al., 2000).

- Additional Site characterization data have been collected, including data for areas not addressed by the preliminary or draft RAs.

- Future land use has changed from what was evaluated in previous RAs.

1.4 Overview of the Risk Assessment Process

Risk assessment is an established approach to evaluate the potential for impacts to human health and the environment associated with exposure to toxic constituents. Risk assessment is a management-decision tool, and does not provide absolute statements about health and environmental impacts, and typically focuses on constituents and exposure pathways directly related to a site. These assessments do not address risks from other sources of exposure (e.g., dietary exposures), or risks from other constituents that are not associated with the site under evaluation. Risk managers use the results of risk assessments to assist in determining if a site, or portion thereof, requires remediation.

1.5 Comparison of the MTCA Risk Assessment Process with the EPA Superfund Risk Assessment Process

The risk assessment process identified in MTCA differs from the traditional EPA Superfund risk assessment process presented in Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (EPA, 1989). Under Superfund, risk assessments are typically comprised of the following five tasks:

1. **Data Evaluation, Reduction, and Screening**. This task identifies potential constituents of concern from analytical data obtained from the field-sampling program. Constituents detected in at least one sample during the field investigation are identified and screened against risk-based screening concentrations to obtain a final list of constituents of potential concern (COPCs) to be evaluated in the risk assessment.

2. **Exposure Assessment**. This task identifies potentially exposed populations (e.g., children, adults, and potentially, plants and animals), exposure scenarios, exposure pathways, and exposure factors. The algorithms used to calculate intake also are presented in this section.

3. **Toxicity Assessment**. This task identifies toxicity values for the COPCs identified in task 1. Toxicity values include noncarcinogenic reference doses and carcinogenic slope factors for humans and noncancer toxicity information for plants and animals.

4. **Risk Characterization**. This task presents the human noncancer and incremental cancer risks, and the ecological hazard quotients associated with exposure to the COPCs that were calculated using the information described in tasks 1 - 3.

5. **Uncertainty Analysis**. This task identifies key uncertainties that should be considered when assessing the risks developed in task 4.

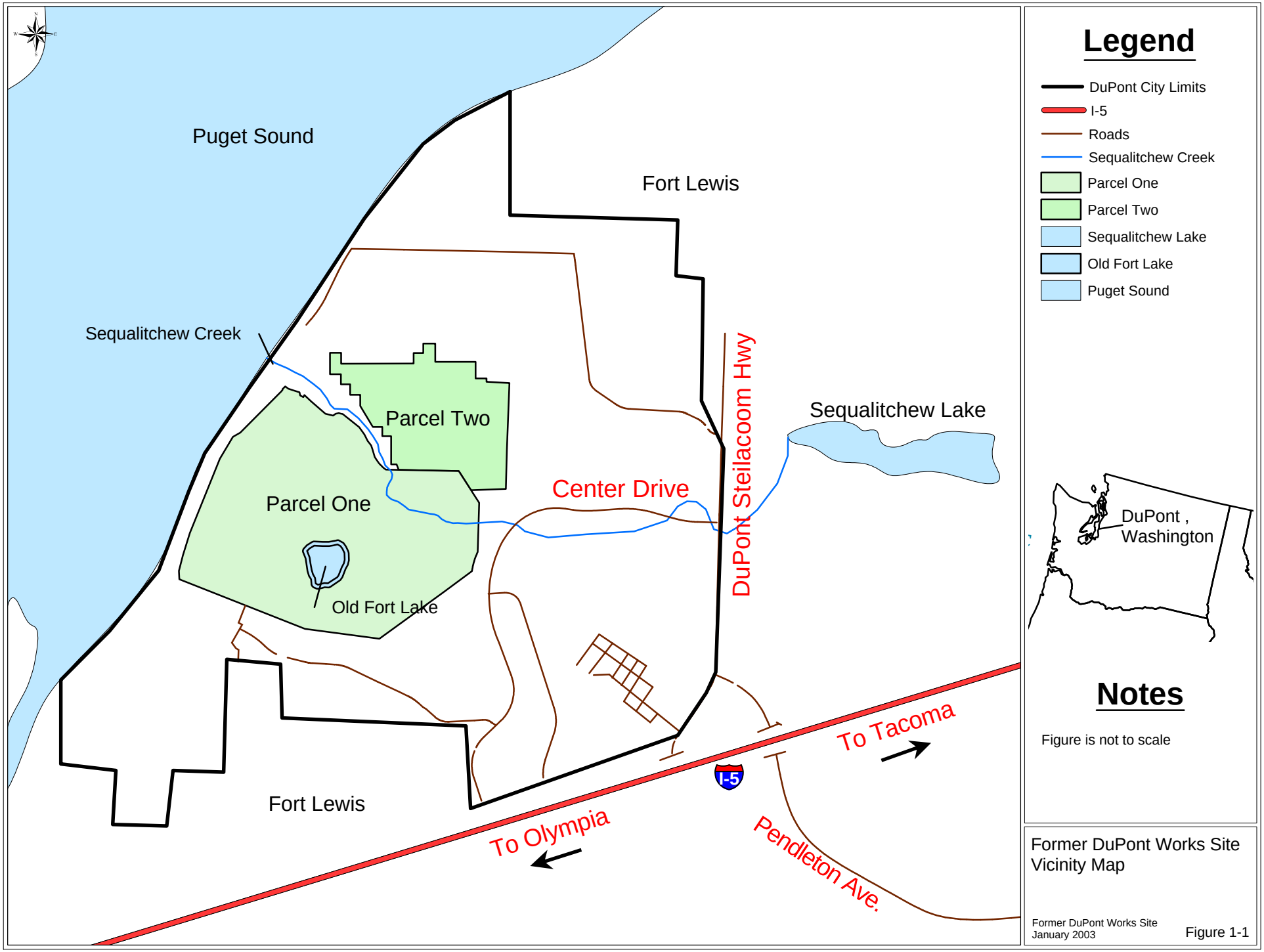
After the initial Data Evaluation, Reduction, and Screening step, which is the first component of any evaluation, the MTCA risk assessment process could be described as performing an EPA Superfund risk assessment in "reverse". That is, risk-based cleanup levels and remediation levels are developed for each constituent considering land-use, exposed populations, exposure pathways, and toxicity information based on prescribed noncancer and incremental cancer risk levels. Under MTCA, human health risk assessments are typically comprised of the following 3 tasks:

1. **Data Evaluation, Reduction, and Screening (Chapter 2)**. This task identifies potential constituents of concern from analytical data obtained from the field-sampling program. Constituents detected in at least one sample during the field investigation are identified for further evaluation in the risk assessment. This is similar to task 1 in the Superfund risk assessment process.

2. **Development of Cleanup Levels and Remediation Levels (Chapter 3)**. This task identifies concentrations for each constituent that are protective of human health and/or the environment. For noncarcinogenic constituents these concentrations are established at levels that would not cause illness in humans. For carcinogenic constituents these concentrations are established at levels that would not cause exceedances of the allowable level of excess cancer risk (as defined in MTCA) in humans. If applicable to a particular site, cleanup levels and remediation levels also are established for each constituent at levels that would be protective of terrestrial or aquatic receptors (e.g., plants and animals). For human health risk assessments, this task generally incorporates elements of task 2 – Exposure Assessment and task 3 – Toxicity Assessment of the Superfund risk assessment process. That is, cleanup levels and remediation levels are developed for specific land-uses, potentially exposed populations, and typically incorporate the most current toxicity information.

3. **Comparison of Site Media Concentrations to Cleanup Levels and Remediation Levels (Chapter 4)**. This task compares the site media concentrations, identified and summarized in task 1, with the cleanup levels and remediation levels identified in task 2. This task is similar to the risk characterization task of the Superfund risk assessment process; but, the results of EPA Superfund risk assessments and MTCA risk assessments are expressed differently. The results of an EPA Superfund risk assessment are expressed as noncancer health effects or incremental cancer risks. In contrast, the results of a MTCA Risk Assessment are expressed as exceedances of the cleanup levels and remediation levels.

Throughout this report, tables and figures are presented at the end of each chapter in which they are discussed. Chapters in this report are supplemented by Appendices, that provide supporting documentation of items discussed in the text.



Former DuPont Works Site
Vicinity Map

Former DuPont Works Site
January 2003

Figure 1-1

1.6 References

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